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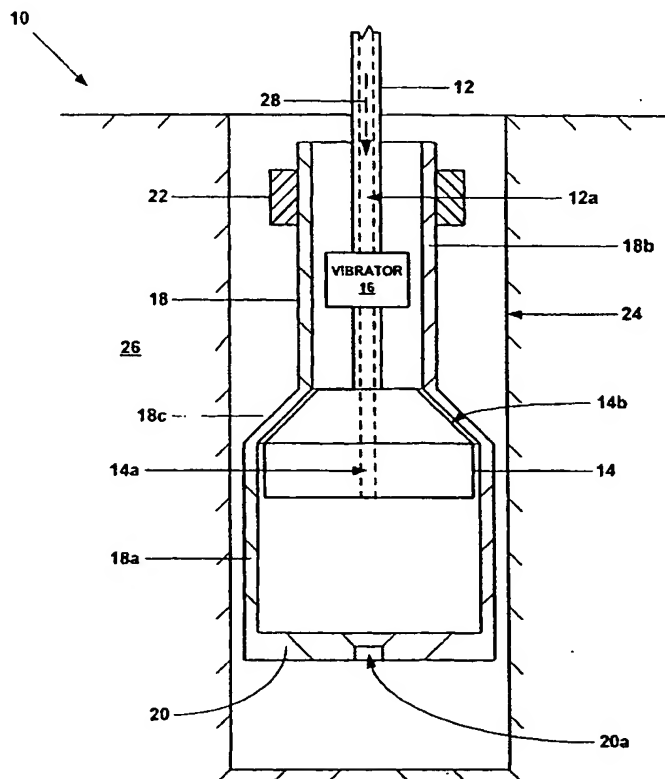
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LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,
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(54) Title: SYSTEM FOR RADIALY EXPANDING TUBULAR MEMBERS



(57) Abstract: A system for radially expanding tubular members (18) includes an expansion device (14) and a vibratory device (16) that generates vibratory energy for agitating at least one of the expansion device (16) and/or the expandable tubular member (18).

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/38550

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E21B 43/10, 28/00, 29/10

US CL : 166/207, 380, 177.6

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 166/207, 380, 177.6, 55.1, 277, 384, 206-217, 242.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST: vibrator, tubular, expansion, frequency

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P ---	WO 03/064813 A1 (e2TECH LIMITED) 7 August 2003 (07.08.2003), pages 3-18.	1-8,15-37,46-70,79-110
Y,P		
Y	US 4,384,625 A (ROPER et al) 24 May 1983 (24.05.1983), column 6, lines 50-54, figure 1.	9-16,38-45,71-78 9-16,38-45,71-78
X	US 4,204,312 A (TOOKER) 27 May 1980 (27.05.1980), column 2, lines 14-51, figure 1.	1,2,16,25,27,31,32,47 56,58,62- 65,80,89,91,95,102,106-108
A	US 1,166,040 A (BURLINGHAM) 28 December 1915 (28.12.1915), page 1, lines 71-91.	1,31,64,102
A	US 6,464,014 B1 (BERNAT) 15 October 2002 (15.10.2002), column 5, lines 27-41.	1,31,64,102

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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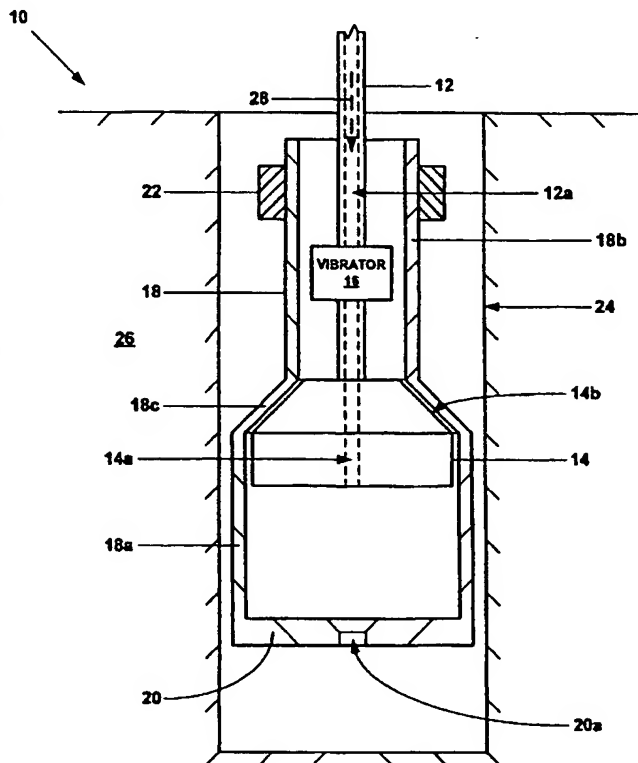
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(54) Title: SYSTEM FOR RADIALLY EXPANDING TUBULAR MEMBERS



(57) Abstract: A system for radially expand-
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the expandable tubular member (18).

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

— with amended claims

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AMENDED CLAIMS

[received by the International Bureau on 11 August 2004 (11.08.2004);
new claims 111-147 added; remaining claims unchanged (24 pages)]

In the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Original) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
 - an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
 - and
 - a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device.
2. (Original) The apparatus of claim 1, wherein the expansion device comprises:
 - a tapered expansion cone.

3. (Original) The apparatus of claim 2, wherein the expansion device further comprises:
an actuator coupled to the tapered expansion cone for displacing the tapered expansion cone in an axial direction relative to the expandable tubular member.
4. (Original) The apparatus of claim 3, wherein the expansion device further comprises:
a locking device coupled to the actuator for fixing the position of the expandable tubular member relative to the actuator during the axial displacement of the expansion cone relative to the expandable tubular member.
5. (Original) The apparatus of claim 1, wherein the expansion device comprises:
a rotary expansion device.
6. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within a non-expanded portion of the expandable tubular member.
7. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within an expanded portion of the expandable tubular member.
8. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within the expansion device.
9. (Original) The apparatus of claim 1, wherein the vibratory device comprises a plurality of vibratory devices.
10. (Original) The apparatus of claim 9, wherein at least one of the vibratory devices is positioned within a non-expanded portion of the expandable tubular member.
11. (Original) The apparatus of claim 10, wherein at least another one of the vibratory devices is positioned within an expanded portion of the expandable tubular member.
12. (Original) The apparatus of claim 10, wherein at least another one of the vibratory devices is positioned within the expansion device.

13. (Original) The apparatus of claim 11, wherein at least another one of the vibratory devices is positioned within the expansion device.
14. (Original) The apparatus of claim 9, wherein at least one of the vibratory devices is positioned within an expanded portion of the expandable tubular member.
15. (Original) The apparatus of claim 14, wherein at least another one of the vibratory devices is positioned within the expansion device.
16. (Original) The apparatus of claim 9, wherein at least another one of the vibratory devices is positioned within the expansion device.
15. (Original) The apparatus of claim 1, wherein the vibratory device comprises:
a fluid powered vibratory device.
16. (Original) The apparatus of claim 1, wherein the vibratory energy comprises:
vibratory energy in one or more planes.
17. (Original) The apparatus of claim 16, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
18. (Original) The apparatus of claim 17, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
19. (Original) The apparatus of claim 16, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.
20. (Original) The apparatus of claim 19, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.

21. (Original) The apparatus of claim 20, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
22. (Original) The apparatus of claim 1, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
23. (Original) The apparatus of claim 22, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.
24. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is variable.
25. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is constant.
26. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is variable.
27. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is constant.
28. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a wellbore casing.
29. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a pipeline.
30. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a structural support.
31. (Original) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and
injecting vibratory energy into at least one of the expandable tubular member and the expansion device.

32. (Original) The method of claim 31, further comprising:

displacing the expansion device in an axial direction relative to the expandable tubular member during the radial expansion and plastic deformation.

33. (Original) The method of claim 32, further comprising:

fixing the position of the expandable tubular member relative to the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.

34. (Original) The method of claim 31, further comprising:

rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.

35. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

36. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

37. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within the expansion device.

38. (Original) The method of claim 31, wherein the vibratory energy is injected from a plurality of locations.

39. (Original) The method of claim 38, wherein at least some portion of the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

40. (Original) The method of claim 39, wherein at least another portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.
41. (Original) The method of claim 39, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
42. (Original) The method of claim 40, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
43. (Original) The method of claim 38, wherein at least some portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.
44. (Original) The method of claim 43, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
45. (Original) The method of claim 38, wherein at least a portion of the vibratory energy is injected from a location within the expansion device.
46. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises:
injecting fluidic materials into the expandable tubular member.
47. (Original) The method of claim 31, wherein the vibratory energy comprises:
vibratory energy in one or more planes.
48. (Original) The method of claim 47, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.
49. (Original) The method of claim 48, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.

50. (Original) The method of claim 47, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.
51. (Original) The method of claim 50, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center
frequencies.
52. (Original) The method of claim 51, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center
frequencies.
53. (Original) The method of claim 31, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center
frequencies.
54. (Original) The method of claim 53, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center
frequencies.
55. (Original) The method of claim 31, wherein the magnitude of the vibratory energy is
variable.
56. (Original) The method of claim 31, wherein the magnitude of the vibratory energy is
constant.
57. (Original) The method of claim 31, wherein the plane of the vibratory energy is variable.
58. (Original) The method of claim 31, wherein the plane of the vibratory energy is constant.
59. (Original) The method of claim 31, wherein the expandable tubular member comprises
a wellbore casing.
60. (Original) The method of claim 31, wherein the expandable tubular member comprises
a pipeline.

61. (Original) The method of claim 31, wherein the expandable tubular member comprises a structural support.
62. (Original) The apparatus of claim 1, wherein the vibratory device coupled to the expansion device generates vibratory energy to agitate the expandable tubular member and the expansion device.
63. (Original) The method of claim 31, further comprising:
injecting vibratory energy into the expandable tubular member and the expansion device.
64. (Original) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device.
65. (Original) The system of claim 64, further comprising:
means for displacing the expansion device in an axial direction relative to the expandable tubular member during the radial expansion and plastic deformation.
66. (Original) The system of claim 65, further comprising:
means for fixing the position of the expandable tubular member relative to the means for displacing the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.
67. (Original) The system of claim 64, further comprising:
means for rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.
68. (Original) The system of claim 64, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

69. (Original) The system of claim 64, wherein the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.
70. (Original) The system of claim 64, wherein the vibratory energy is injected for a location within the expansion device.
71. (Original) The system of claim 64, wherein the vibratory energy is injected from a plurality of locations.
72. (Original) The system of claim 71, wherein at least some portion of the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.
73. (Original) The system of claim 72, wherein at least another portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.
74. (Original) The system of claim 72, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
75. (Original) The system of claim 73, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
76. (Original) The system of claim 71, wherein at least some portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.
77. (Original) The system of claim 76, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.
78. (Original) The system of claim 71, wherein at least a portion of the vibratory energy is injected from a location within the expansion device.
79. (Original) The system of claim 64, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises:

injecting fluidic materials into the expandable tubular member.

80. (Original) The system of claim 64, wherein the vibratory energy comprises:
vibratory energy in one or more planes.
81. (Original) The system of claim 80, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center
frequencies.
82. (Original) The system of claim 81, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center
frequencies.
83. (Original) The system of claim 80, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.
84. (Original) The system of claim 83, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center
frequencies.
85. (Original) The system of claim 84, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center
frequencies.
86. (Original) The system of claim 64, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center
frequencies.
87. (Original) The system of claim 86, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center
frequencies.
88. (Original) The system of claim 64, wherein the magnitude of the vibratory energy is
variable.

89. (Original) The system of claim 64, wherein the magnitude of the vibratory energy is constant.
90. (Original) The system of claim 64, wherein the plane of the vibratory energy is variable.
91. (Original) The system of claim 64, wherein the plane of the vibratory energy is constant.
92. (Original) The system of claim 64, wherein the expandable tubular member comprises a wellbore casing.
93. (Original) The system of claim 64, wherein the expandable tubular member comprises a pipeline.
94. (Original) The system of claim 64, wherein the expandable tubular member comprises a structural support.
95. (Original) The system of claim 64, further comprising:
means for injecting vibratory energy into the expandable tubular member and the expansion device.
96. (Original) The apparatus of claim 19, wherein one of the planes is radial; and wherein another one of the planes is longitudinal.
97. (Original) The method of claim 50, wherein one of the planes is radial; and wherein another one of the planes is longitudinal.
98. (Original) The system of claim 83, wherein one of the planes is longitudinal; and wherein another one of the planes is radial.
99. (Original) The apparatus of claim 1, further comprising:
a vibratory device coupled to the expansion device for generating vibratory energy to impart rotation to the expansion device.

100. (Original) The method of claim 31, further comprising:
injecting vibratory energy into the expansion device to impart rotation to the expansion device.
101. (Original) The system of claim 64, further comprising:
means for injecting vibratory energy into the expansion device to impart rotation to the expansion device.
102. (Original) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
means for radially expanding and plastically deforming the expandable tubular member; and
means for reducing the required radial expansion forces during the radial expansion and plastic deformation of the expandable tubular member.
103. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expandable tubular member.
104. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:
impacting the expandable tubular member.
105. (Original) The system of claim 64, wherein means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:
means for impacting the expandable tubular member.
106. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expansion device.
107. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:
impacting the expansion device.

108. (Original) The system of claim 64, wherein means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:

means for impacting the expansion device.

109. (Original) The method of claim 31, further comprising:

inserting the expansion device and the expandable tubular member into a preexisting structure; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device during the insertion.

110. (Original) The method of claim 31, further comprising:

removing the expansion device and the expandable tubular member from a preexisting structure; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device during the removal.

111. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate spherical surfaces.

112. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;
wherein the expansion device comprises one or more external arcuate elliptical surfaces.

113. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

114. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

115. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate spherical surfaces.

116. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
- radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - injecting vibratory energy into at least one of the expandable tubular member and the expansion device;
- wherein the expansion device comprises one or more external arcuate elliptical surfaces.

117. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
- radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - injecting vibratory energy into at least one of the expandable tubular member and the expansion device;
- wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

118. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
- radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - injecting vibratory energy into at least one of the expandable tubular member and the expansion device;
- wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

119. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and
a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;
wherein the expansion device comprises a rotary expansion device.

120. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member by rotating an expansion device within the expandable tubular member; and
injecting vibratory energy into at least one of the expandable tubular member and the expansion device.

121. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and
a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;
wherein the vibratory device is positioned within an expanded portion of the expandable tubular member.

122. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the radially expanded and plastically deformed portion of the expandable tubular member.

123. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory device is positioned within the expansion device.

124. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member;
and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the expansion device.

125. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory device comprises a plurality of vibratory devices.

126. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member
by using an expansion device within the expandable tubular member;
and
injecting vibratory energy into at least one of the expandable tubular member
and the expansion device from a plurality of discrete spaced apart
locations.

127. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially
expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory
energy to agitate at least one of the expandable tubular member and
the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency
distribution having a plurality of center frequencies.

128. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member
by using an expansion device within the expandable tubular member;
and

injecting vibratory energy into at least one of the expandable tubular member
and the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency
distribution having a plurality of center frequencies.

129. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially
expanding and plastically deforming the expandable tubular member;
and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;
wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and
wherein the vibratory energy comprises vibratory energy in a plurality of planes.

130. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member;
and
injecting vibratory energy into at least one of the expandable tubular member and the expansion device;
wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and
wherein the vibratory energy comprises vibratory energy in a plurality of planes.

131. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member;
and
a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;
wherein the plane of the vibratory energy is variable.

132. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and
injecting vibratory energy into at least one of the expandable tubular member and the expansion device;
wherein the plane of the vibratory energy is variable.

133. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy has a center frequency of about 40 Hz.

134. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy has a center frequency of about 40 Hz.

135. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device; and

means for rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.

136. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
- means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the radially expanded and plastically deformed portion of the expandable tubular member.
137. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
- means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the expansion device.
138. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:
- an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and
 - a vibratory device coupled to the expansion device for imparting rotation to the expansion device.
139. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
- radially expanding and plastically deforming the expandable tubular member using an expansion device; and
 - injecting vibratory energy into expansion device to impart rotation to the expansion device.

140. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member using an expansion device; and
increasing the plasticity and formability of the expandable tubular before the radial expansion and plastic deformation of the expandable tubular member.
141. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
means for increasing the plasticity and formability of the expandable tubular before the radial expansion and plastic deformation of the expandable tubular member.
142. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member using an expansion device; and
increasing the plasticity and formability of the expandable tubular during the radial expansion and plastic deformation of the expandable tubular member.
143. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
means for increasing the plasticity and formability of the expandable tubular during the radial expansion and plastic deformation of the expandable tubular member.
144. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:
radially expanding and plastically deforming the expandable tubular member using an expansion device;

injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

during the radial expansion and plastic deformation of the expandable tubular member:

- a) incrementing at least one of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

145. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

means for during the radial expansion and plastic deformation of the expandable tubular member:

- a) means for incrementing at least one of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) means for monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) means for repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

146. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device;

Injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

during the radial expansion and plastic deformation of the expandable tubular member:

- a) incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

147. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

means for during the radial expansion and plastic deformation of the expandable tubular member:

- a) means for incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;
- b) means for monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and
- c) means for repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

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